

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference MR/04-001.PCT	<b>FOR FURTHER ACTION</b>	See item 4 below
International application No. PCT/US2005/005744	International filing date ( <i>day/month/year</i> ) 22 February 2005 (22.02.2005)	Priority date ( <i>day/month/year</i> ) 22 February 2004 (22.02.2004)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant MEDRAD, INC.		

1.	This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).																								
2.	This REPORT consists of a total of 12 sheets, including this cover sheet.  In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.																								
3.	<p>This report contains indications relating to the following items:</p> <table style="width: 100%;"> <tr> <td style="width: 10%; text-align: center;"><input checked="" type="checkbox"/></td> <td style="width: 30%;">Box No. I</td> <td style="width: 60%;">Basis of the report</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table>	<input checked="" type="checkbox"/>	Box No. I	Basis of the report	<input type="checkbox"/>	Box No. II	Priority	<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input checked="" type="checkbox"/>	Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/>	Box No. VI	Certain documents cited	<input checked="" type="checkbox"/>	Box No. VII	Certain defects in the international application	<input type="checkbox"/>	Box No. VIII	Certain observations on the international application
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<input type="checkbox"/>	Box No. VIII	Certain observations on the international application																							
4.	The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).																								

<p style="text-align: center;">The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No. +41 22 338 82 70</p>	<p>Date of issuance of this report 22 August 2006 (22.08.2006)</p> <p>Authorized officer  <b>Yoshiko Kuwahara</b></p> <p>e-mail: pt07@wipo.int</p>
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# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

REC'D 30 MAY 2006

PCT

PCT

To:  
JAMES R. STEVENSON  
MEDRAD, INC.  
ONE MEDRAD DRIVE  
INDIANOLA, PA 15051

## WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing  
(day/month/year) **25 MAY 2006**

**FOR FURTHER ACTION**

See paragraph 2 below

Applicant's or agent's file reference

MR/04-001.PCT

International application No.

PCT/US05/05744

International filing date (day/month/year)

22 February 2005 (22.02.2005)

Priority date (day/month/year)

22 February 2004 (22.02.2004)

International Patent Classification (IPC) or both national classification and IPC

IPC: **G01V 3/00( 2006.01)**

USPC: 324/318,309

Applicant

MEDRAD, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

### 2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US

Mail Stop PCT, Attn: ISA/US  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

Facsimile No. (571) 273-3201

Date of completion of this  
opinion

23 April 2006 (23.04.2006)

Authorized officer

Gutierrez Diego

Telephone No. (703)305-0956

Form PCT/ISA/237 (cover sheet) (April 2005)

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US05/05744

**Box No. I Basis of this opinion**

1. With regard to the language, this opinion has been established on the basis of:
  - ☒ the international application in the language in which it was filed
  - ☐ a translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
  - a. type of material
    - ☐ a sequence listing
    - ☐ table(s) related to the sequence listing
  - b. format of material
    - ☐ on paper
    - ☐ in electronic form
  - c. time of filing/furnishing
    - ☐ contained in the international application as filed.
    - ☐ filed together with the international application in electronic form.
    - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has, within the applicable time limit:
- ☐ paid additional fees
  - ☐ paid additional fees under protest and, where applicable, the protest fee
  - ☐ paid additional fees under protest but the applicable protest fee was not paid
  - ☒ not paid additional fees
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is
- ☐ complied with
  - ☒ not complied with for the following reasons:  
See the lack of unity section of the International Search Report (Form PCT/ISA/210)

4. Consequently, this opinion has been established in respect of the following parts of the international application:
- ☐ all parts.
  - ☒ the parts relating to claims Nos. 1-71

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Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims <u>16, 34, 51, 59</u>	YES
	Claims <u>1-15, 17-33, 35-50, 52-58, 60-71</u>	NO
Inventive step (IS)	Claims <u>NONE</u>	YES
	Claims <u>1-71</u>	NO
Industrial applicability (IA)	Claims <u>1-71</u>	YES
	Claims <u>NONE</u>	NO

2. Citations and explanations:

Please See Continuation Sheet

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**Box No. VII Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

Claim 15 is objected to under PCT Rule 66.2(a)(iii) as containing the following defect(s) in the form or contents thereof: Claim 15 depends from claim C1, there is no claim C1. The examiner is treating this claim as if it depends from claim 1, a correction to the dependency is needed.

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**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

**V. 2. Citations and Explanations:**

Claims 1-15, 17-29, 31-33, 35-50, 52-58, and 60-71 lack novelty under PCT Article 33(2) as being anticipated by Srinivasan US patent 5,664,568 issued September 9<sup>th</sup> 1997.

With respect to Claim 1, Srinivasan '568 teaches and shows "A neurovascular array for use with a magnetic resonance (MR) system capable of parallel-imaging via a plurality of processing channels" [See figures 1, 2, 3, 9, and 10; the abstract, col. 3 line 51 through col. 10 line 67.] Srinivasan '568 teaches and shows, "the neurovascular array comprising: (a) a head coil" (i.e. head coil birdcage assembly 42) "having: (I) a first electrically conductive ring, (II) a second electrically conductive ring, and (III) a plurality of rods electrically interconnecting said first and said second rings to form a birdcage-like structure therewith", [See figures 2 and 3, col. 6 line 49 through col. 10 line 67]. "wherein said rods and said first and said second rings are configured to produce a plurality of electrically-adjacent primary resonant substructures about the birdcage-like structure, with each of said primary resonant substructures: (A) constituting a coil element including two of said rods neighboring each other and a corresponding short segment of each of said first and said second rings interconnecting them, so that each of said primary resonant substructures is enabled to receive a magnetic resonance signal from tissue within a field of view thereof, and (B) providing a source impedance considerably higher than, and for creating a resonant circuit with, a load impedance to which said primary resonant substructure connects so as to enable said primary resonant substructure (i) to be operatively couplable to one processing channel of the MR system for conveyance of the magnetic resonance signal received thereby (ii) while simultaneously being at least partially decoupled from the other of said primary resonant substructures of said head coil;" [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67]. "(b) an anterior coil having in proximity to said head coil at least one other coil element for receiving a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '568 abstract, anterior coil 44a col. 6 line 49 through col. 10 line 67] "(c) a posterior coil having in proximity to said head coil at least one other coil element for receiving a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '568 abstract, posterior coil 44b col. 6 line 49 through col. 10 line 67] "and (d) an interface for enabling said coil elements of said head coil, said anterior coil and said posterior coil to be selectively interconnected to the processing channels of the MR system so that the neurovascular array can be selectively operated in a plurality of modes." [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67].

With respect to volume coil Claim 21, and the corresponding method claim for making the volume coil Claim 71, Srinivasan '568



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**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

teaches and shows "A volume coil for use with a parallel-imaging compatible magnetic resonance (MR) system, [See figures 1, 2, 3, 9, and 10; the abstract, col. 3 line 51 through col. 10 line 67.] Srinivasan '568 teaches and shows, "the volume coil comprising: (a) a first electrically conductive ring;" [i.e. component 88a Srinivasan '568 col. 7 lines 7-8], "(b) a second electrically conductive ring; [i.e. component 88b Srinivasan '568 col. 7 lines 7-8], "(c) a plurality of rods electrically interconnecting said first and said second rings to form a birdcage-like structure therewith;" [See the "legs of birdcage coil 42 in figures 3 and 2, col. 6 line 49 through col. 10 line 67] "wherein said rods and said first and said second rings are configured to produce a plurality of electrically-adjacent primary resonant substructures about the birdcage-like structure, with each of said primary resonant substructures including two of said rods neighboring each other and a corresponding short segment of each of said first and said second rings interconnecting them, [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67]. "so that each of said primary resonant substructures is enabled to receive a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '568 abstract, col. 4 lines 35-57; col. 6 line 32 through col. 10 line 67] "and (d) each of said primary resonant substructures having a source impedance considerably higher than, and for creating a resonant circuit with, a load impedance to which said primary resonant substructure connects so as to enable said primary resonant substructure (i) to be operatively couplable to one processing channel of the MR system for conveyance of the magnetic resonance signal received thereby (ii) while simultaneously being at least partially decoupled from the other of said primary resonant substructures of the volume coil. [See Srinivasan '568 abstract, figures 1 through 10; table 1; col. 3 line 51 through col. 10 line 67].

With respect to Claim 39, Srinivasan '568 teaches and shows "A neurovascular array for use with a magnetic resonance (MR) system having a plurality of processing channels" [See figures 1, 2, 3, 9, and 10; the abstract, col. 3 line 51 through col. 10 line 67.] Srinivasan '568 teaches and shows, "the neurovascular array comprising: (a) a head coil" (i.e. head coil birdcage assembly 42) "including: (I) a first electrically conductive ring;" [i.e. component 88a Srinivasan '568 col. 7 lines 7-8], "(II) a second electrically conductive ring; [i.e. component 88b Srinivasan '568 col. 7 lines 7-8], "and (II) a plurality of rods electrically interconnecting said first and said second rings to form a birdcage-like structure therewith;" [See the "legs of birdcage coil 42 in figures 3 and 2, col. 6 line 49 through col. 10 line 67] "wherein said rods and said first and said second rings are configured to produce a plurality of electrically-adjacent primary resonant substructures about the birdcage-like structure, with each of said primary resonant substructures constituting a coil element including two of said rods neighboring each other and a corresponding short segment of each of said first and said second rings interconnecting them, so that said primary resonant substructures are isolated from each other via a preamplifier decoupling scheme and an offset tuning scheme" [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67, table 1]. "thereby enabling each of said primary resonant substructures (i) to receive a magnetic resonance signal from tissue within a field of view thereof and (ii) to be operatively couplable to one processing channel of the MR system for conveyance of the magnetic resonance signal received thereby (iii) while being simultaneously decoupled from the other of said primary resonant substructures;" [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67, table 1]. "(b) an anterior coil having in proximity to said head coil at least one other coil element for receiving a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '568 abstract, anterior coil 44a col. 6 line 49 through col. 10 line 67] "(c) a posterior coil having in proximity to said head coil at least one other coil element for receiving a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '568 abstract, posterior coil 44b col. 6 line 49 through col. 10 line 67] "and (d) an interface for enabling said coil elements of said head coil, said anterior coil and said posterior coil to be selectively interconnected to the processing channels of the MR system so that the neurovascular array can be selectively operated in a plurality of modes." [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67].

With respect to Claim 53, and the corresponding method claim for making the volume coil Claim 68, Srinivasan '568 teaches and shows "A volume coil for use with a parallel-imaging compatible magnetic resonance (MR) system" [See figures 1, 2, 3, 9, and 10; the abstract, col. 3 line 51 through col. 10 line 67.] Srinivasan '568 teaches and shows, "the volume coil comprising: (a) a first electrically conductive ring;" [i.e. component 88a Srinivasan '568 col. 7 lines 7-8], "(b) a second electrically conductive ring; [i.e. component 88b Srinivasan '568 col. 7 lines 7-8], "(c) a plurality of rods electrically interconnecting said first and said second rings to form a birdcage-like structure therewith; [See the "legs of birdcage coil 42 in figures 3 and 2, col. 6 line 49 through col. 10 line 67] "wherein said rods and said first and said second rings are configured to produce a plurality of electrically-adjacent primary resonant substructures about the birdcage-like structure, with each of said primary resonant substructures including two of said rods neighboring each other and a corresponding short segment of each of said first and said second rings interconnecting them, so that said primary resonant substructures are isolated from each other via a preamplifier decoupling scheme and an offset tuning scheme" [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67, table 1]. "thereby enabling each of said primary resonant substructures (i) to receive a magnetic resonance signal from tissue within a field of view thereof and (ii) to be operatively couplable to one processing channel of the MR system for conveyance of the magnetic resonance signal received thereby (iii) while being simultaneously decoupled from the other of said primary resonant substructures." [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67, table 1].

With respect to Claim 61, Srinivasan '568 teaches and shows "An array for use with a magnetic resonance (MR) system having a plurality of processing channels, the array comprising: (a) a volume coil including: (I) a first ring at one end of said volume coil, said first ring being electrically conductive; (II) a second ring at an other end of said volume coil, said second ring being electrically conductive; and (II) a plurality of rods electrically interconnecting said first and said second rings to form a birdcage-like structure



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**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

therewith; wherein said rods and said first and said second rings are configured to produce a plurality of electrically-adjacent primary resonant substructures about the birdcage-like structure, with each of said primary resonant substructures constituting a coil element including two of said rods neighboring each other and a corresponding short segment of each of said first and said second rings interconnecting them, so that said primary resonant substructures are isolated from each other via a preamplifier decoupling scheme and an offset tuning scheme thereby enabling each of said primary resonant substructures (i) to receive a magnetic resonance signal from tissue within a field of view thereof and (ii) to be operatively couplable to one processing channel of the MR system for conveyance of the magnetic resonance signal received thereby (iii) while being simultaneously decoupled from the other of said primary resonant substructures;" [See the same rejection reasons as those provided with respect to claim 53 above.] Srinivasan '568 also teaches and shows "(b) a secondary coil" [See Srinivasan '568 abstract, anterior coil 44a col. 6 line 49 through col. 10 line 67] "having at least one other coil element for receiving a magnetic resonance signal from tissue within a field of view thereof;" [See col. 6 line 49 through col. 10 line 67] "(c) a tertiary coil having at least one other coil element for receiving a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '568 abstract, posterior coil 44b col. 6 line 49 through col. 10 line 67] "and (d) an interface for enabling said coil elements of said volume coil, said secondary coil and said tertiary coil to be selectively interconnected to the processing channels of the MR system so that the array can be selectively operated in a plurality of modes." [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67].

With respect to Claim 2, corresponding claim 40, Srinivasan '568 teaches and shows that "said plurality of modes includes a neurovascular phased array mode in which said interface enables: (a) each pair of said coil elements of said head coil to be interconnected with a separate one of the processing channels of the MR system;" [See Srinivasan '568 col. 9 line 36 through col. 10 line 67; table 1; col. 6 lines 32-62; col. 3 line 52 through col. 4 line 67; in combination with figures 3, 9, and 10] "and (b) each of said other coil elements of said anterior and said posterior coils to be interconnected with a separate one of the processing channels of the MR system." [See Srinivasan '568 col. 9 line 36 through col. 10 line 67; table 1; col. 6 lines 32-62; col. 3 line 52 through col. 4 line 67; in combination with figures 3, 9, and 10] The same reasons for lack of novelty, that apply to claims 1, 39 also apply to claims 2, 40 and need not be reiterated.

With respect to Claim 3, corresponding claim 41, Srinivasan '568 teaches and shows that "said head coil has eight of said coil elements and said anterior and said posterior coils each have two of said other coil elements" [See col. 10 lines 23-67], "for use with the MR system equipped with at least eight of the processing channels" [See col. 10 lines 23-67]. The same reasons for lack of novelty, that apply to claims 1, 39 also apply to claims 3, 41 and need not be reiterated.

With respect to Claim 4, corresponding claim 42, Srinivasan '568 teaches and shows that "said plurality of modes includes a high resolution brain mode in which said interface enables each of said coil elements of said head coil to be interconnected with a separate one of the processing channels of the MR system." [See table 1, col. 9 line 36 through col. 10 line 67; col. 6 lines 38-44; figures 3, 9, and 10] The same reasons for lack of novelty, that apply to claims 1, 39 also apply to claims 4, 42 and need not be reiterated.

With respect to Claim 5, corresponding claim 43, Srinivasan '568 teaches and shows that "said plurality of modes includes a volume neck mode in which said interface enables each of said other coil elements of said anterior and said posterior coils to be interconnected with a separate one of the processing channels of the MR system." [See table 1, col. 9 line 36 through col. 10 line 67; col. 6 lines 38-44; figures 3, 9, and 10] The same reasons for lack of novelty, that apply to claims 1, 39 also apply to claims 5, 43 and need not be reiterated.

With respect to Claim 6, corresponding claim 44, Srinivasan '568 teaches and shows that "said plurality of modes includes a spectroscopy mode in which said interface enables all of said coil elements of said head coil to be interconnected with a single one of the processing channels of the MR system." [See table 1, col. 9 line 36 through col. 10 line 67; col. 6 lines 32-62; col. 4 lines 36-67 figures 3, 9, and 10] The same reasons for lack of novelty, that apply to claims 1, 39 also apply to claims 6, 44 and need not be reiterated.

With respect to Claim 7, corresponding claim 45, Srinivasan '568 teaches and shows that "said interface is capable of enabling said neurovascular array to be selectively operated in said plurality of modes when said coil elements of said head coil, said anterior coil and said posterior coil are greater in number than the processing channels of the MR system." [See table 1, col. 9 line 36 through col. 10 line 67; especially col. 10 lines 23-67; col. 6 lines 32-62; col. 4 lines 36-67 figures 3, 9, and 10] The same reasons for lack of novelty, that apply to claims 1, 39 also apply to claims 7, 45 and need not be reiterated.

With respect to neurovascular array Claim 8, and corresponding volume coil claim 22, Srinivasan '568 teaches and shows that "each of said primary resonant substructures as said source impedance includes an input resonant circuit for enabling said primary resonant substructure via a low impedance preamplifier as said load impedance to be (i) operatively couplable to one processing channel of the MR system and (ii) at least partially decoupled from the other of said primary resonant substructures." [See col. 7 line 53 col. 9 line 34; col. 4 lines 2-67; and figures 3, 9, and 10; in combination with col 9 line 35 through col. 10 line 67.] The same reasons for lack of novelty, that apply to claims 1, 21 also apply to claims 8, and 22 and need not be reiterated.

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INTERNATIONAL SEARCHING AUTHORITY**

International application No.  
PCT/US05/05744

**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

With respect to neurovascular array Claim 9, and corresponding volume coil claim 23, Srinivasan '568 teaches and shows that "said low impedance preamplifiers are provided as part of the neurovascular array" (i.e. claim 9) or "volume coil" (i.e. claim 23)." [See figures 3, 9, and 10; col. 10 lines 11-67] The same reasons for lack of novelty, that apply to claims 1, 8, 21, 22 also apply to claims 9, and 23 and need not be reiterated.

With respect to neurovascular array Claim 10, and corresponding volume coil claim 24, Srinivasan '568 teaches and shows that "each of said low impedance preamplifiers is provided with one of the processing channels of the MR system." [See figures 3, 9, and 10; col. 10 lines 11-67] The same reasons for lack of novelty, that apply to claims 1, 8, 21, 22 also apply to claims 10 and 24 and need not be reiterated.

With respect to neurovascular array Claim 11, and corresponding volume coil claim 25, Srinivasan '568 teaches and shows that "each of said primary resonant substructures has said input resonant circuit corresponding thereto located in one of said short segment of said second ring thereof and said short segment of said first ring thereof." [See col. 3 line 51 through col. 10 line 67 in combination with figures 3, 5, 4, 4a, 4b, 6, 6a and 8c] The same reasons for lack of novelty, that apply to claims 1, 8, 21, 22 also apply to claims 11 and 25 and need not be reiterated.

With respect to neurovascular array corresponding Claims 12, and 13 which respectively depend from claims 1 and 8, and corresponding volume coil Claims 26, and 27 which respectively depend from claims 21 and 22, Srinivasan '568 teaches and shows that "each of said primary resonant substructures further includes at least one of: (a) a tuning circuit in at least one of said rods thereof; (b) a tuning circuit in said short segment thereof of said first ring; and (c) a tuning circuit in said short segment thereof of said second ring; for enabling said head coil to be tuned according to an offset tuning scheme through which each of said primary resonant substructures is (i) further decoupled from the other of said primary resonant substructures and (ii) still enabled to resonate at an operating frequency of said head coil and thus to receive the magnetic resonance signal." [See col. 3 line 51 through col. 10 line 67; figures 1 through 8c] The same reasons for lack of novelty, that apply to claims 1, 8, 21, and 22, also apply to corresponding claims 12, 13; 26, and 27; and need not be reiterated.

With respect to neurovascular array Claim 14, and corresponding volume coil claim 29, Srinivasan '568 teaches and shows that in the alternative examples birdcage coil 140, or 150 of respectively figures 9 and 10 is used to uniform head/brain coverage in which "said second ring of said head coil" (i.e. either 142a, 142b, or 144 in figure 9; or 152a, 152b, 154a, or 154b of figure 10) "has a diameter that is smaller than that of said first ring" (i.e. claim 29) or "of said first ring of said head coil" (i.e. claim 14) [See components 140 or 150 of figures 9 and 10 respectively, See also col. 10 lines 23-67 where alternate embodiments and other geometries for the birdcage coil are disclosed; Additionally figure 2 also suggests this limitation the initial entry opening of figure 2 has different size diameter than the remainder of the coils structure]. The same reasons for lack of novelty, that apply to claims 1, 21 also apply to claims 14, 29 and need not be reiterated.

With respect to corresponding neurovascular array Claims 15, 50 which depend from claims 1 and 39 respectively, and corresponding volume coil claims 33, 58 which depend from claims 21 and 53 respectively, Srinivasan '568 shows from figure 3 that "said plurality of electrically-adjacent primary resonant substructures of said head coil is eight in number, with each being generally deployed 45 degrees apart from its neighbor". [See figure 3, col. 10 lines 23-67.] The same reasons for lack of novelty, that apply to claims 1, 21, 39, 53 also apply to claims 15, 33, 50, 58 and need not be reiterated.

With respect to neurovascular array Claim 17, and corresponding volume coil claim 35, Srinivasan '568 shows from figure 3 that "said primary resonant substructures of said head coil (i.e. claim 17) or volume coil, (i.e. claim 35) are deployed generally symmetrically about the birdcage-like structure." [See figures 3, 5; col. 10 lines 23-67.] The same reasons for lack of novelty, that apply to claims 1, 21 also apply to claims 15, 35 and need not be reiterated.

With respect to neurovascular array Claim 18, and corresponding volume coil claim 36, Srinivasan '568 shows from figure 3 that "selected ones of said rods of said head coil are spaced at irregular distances from adjacent ones of said rods." [See figure 3 and the unevenly distributed rods connecting to the upper and lower connection nodes that start and then vanish.] The same reasons for lack of novelty, that apply to claims 1, 21 also apply to claims 18, 36 and need not be reiterated.

With respect to corresponding neurovascular array Claim 19, 52 which depend from claims 1 and 39 respectively; corresponding volume coil claims 37, 60 which depend from claims 21 and 53 respectively, and corresponding array coil claim 67, Srinivasan '568 teaches and shows from figure 3 that "each of said rods includes a decoupling network therein for decoupling said head coil from a radio frequency transmit field of the MR system during a transmit cycle thereof. [See col. 7 line 53 through col. 10 line 67; the abstract, col. 4 lines 2-67; and col. 6 lines 32-62] The same reasons for lack of novelty, that apply to claims 1, 21, 39, 53; and 61 also apply to claims 19, 37, 52, 60, and 67 and need not be reiterated.

With respect to neurovascular array Claim 20, and corresponding volume coil claim 38, Srinivasan '568 teaches from the two different functions of the decoupling circuits that "each of said decoupling networks includes an active decoupling circuit and a

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passive decoupling circuit" because high impedance shielding during transmission is an active decoupling and isolating flowing currents within the coil assembly generally is effectively passive decoupling. [See col. 7 line 53 through col. 10 line 67; especially col. 8 line 54 through col. 9 line 34.] The same reasons for lack of novelty, that apply to claims 1, 19, 21, 37 also apply to claims 20, 38 and need not be reiterated.

With respect to volume coil claim 28, Srinivasan '568 shows from figure 3 that of claim 21 further including a combiner circuit for combining the magnetic resonance signal received by one of said primary resonant substructures with that received by at least one other of said primary resonant substructures and operatively coupling the magnetic resonance signals to one processing channel of the MR system." [See figures 1, 3, 9, 10, col. 6 line 32 through col. 10 line 67] The same reasons for lack of novelty, that apply to claims 21 also apply to claim 28 and need not be reiterated.

With respect to volume coil claim 31, Srinivasan '568 shows from figure 3 that "said second ring" (i.e. component 88b of Srinivasan '568 col. 7 lines 7-8) "has a diameter that is equal to that of said first ring" (i.e. component 88a of Srinivasan '568 col. 7 lines 7-8). The same reasons for lack of novelty, that apply to claims 21 also apply to claim 31 and need not be reiterated.

With respect to volume coil claim 32, Srinivasan '568 teaches that "said first and said second rings are one of circular and elliptical." [See Srinivasan '568 col. 10 lines 46-47] The same reasons for lack of novelty, that apply to claims 21 also apply to claim 33 and need not be reiterated.

With respect to neurovascular array Claim 46, corresponding volume coil claim 54, corresponding array claim 64, and the corresponding method claim 69, Srinivasan '568 teaches and shows that "said preamplifier decoupling scheme involves each of said primary resonant substructures having an input resonant circuit in said short segment of second ring thereof for enabling said primary resonant substructure via a low impedance preamplifier to be (i) operatively couplable to one processing channel of the MR system and (ii) decoupled thereat from the other of said primary resonant substructures. [See col. 7 line 53 col. 9 line 34; col. 4 lines 2-67; and figures 3, 9, and 10; in combination with col 9 line 35 through col. 10 line 67.] The same reasons for lack of novelty, that apply to claims 39, 53, 61 and 68 also apply to claims 46, 54, 64 and 69 and need not be reiterated.

With respect to neurovascular array Claim 47, corresponding volume coil claim 55, and corresponding array claim 65, Srinivasan '568 teaches and shows that "said low impedance preamplifiers are provided as part of the neurovascular array" (i.e. claim 47) or the "volume coil" (i.e. claim 55), or the "array" (i.e. claim 65)." [See figures 3, 9, and 10; col. 10 lines 11-67] The same reasons for lack of novelty, that apply to claims 39, 46, 53, 54, 61, and 64 also apply to claims 47, 55, and 65 and need not be reiterated.

With respect to neurovascular array Claim 48, and corresponding volume coil claim 56, Srinivasan '568 teaches and shows that "each of said low impedance preamplifiers is provided with one of the processing channels of the MR system." [See figures 3, 9, and 10; col. 10 lines 11-67] The same reasons for lack of novelty, that apply to claims 39, 46, 53, 54 also apply to claims 48 and 56 and need not be reiterated.

With respect to neurovascular array Claim 49, corresponding volume coil claim 57, corresponding array claim 66, and the corresponding method claim 70, Srinivasan '568 teaches and shows that "said offset tuning scheme involves in each of said primary resonant substructures at least one of: (a) a tuning circuit in at least one of said rods thereof; (b) a tuning circuit in said short segment thereof of said first ring; and (c) a tuning circuit in said short segment thereof of said second ring; for enabling each of said primary resonant substructures to be tuned so that signal current induced therein is effectively precluded from interfering with neighboring ones of said primary resonant substructures primarily via said first ring and said rods thereby enabling each of said primary resonant substructures (i) to be decoupled thereat from the other of said primary resonant substructures (ii) while maintaining the ability to resonate at an operating frequency of said head coil and thus to receive the magnetic resonance signal. ." [See col. 3 line 51 through col. 10 line 67; figures 1 through 8c] The same reasons for lack of novelty, that apply to claims 39, 46, 53, 54, 61, 64, and 68, 69 also apply to corresponding claims 49, 57, 66 and 70 and need not be reiterated.

With respect to array Claim 62, Srinivasan '568 teaches and shows that "(a) said volume coil is intended for imaging of a head of a patient;" [See volume coil 42] "(b) said secondary coil is intended for imaging carotid structures on one side of a neck of the patient;" [See the aortic arch on a side of the neck col. 9 line 35 through col. 10 line 67] "and (c) said tertiary coil is intended for imaging carotid structures on an other side of the neck of the patient" [See the aortic arch on an other side of the neck, along with figures 1, 2, 3, 9, and 10] and col. 9 line 35 through col. 10 line 67]. The same reasons for lack of novelty that apply to claims 53, 61 also apply to claim 62 and need not be reiterated.

With respect to array Claim 63, Srinivasan '568 teaches and shows that "(a) said secondary coil is intended for imaging a heart of a patient from an anterior perspective;" [See anterior coil 44a which images the aortic arch of the heart "from an anterior perspective" col. 6 line 49 through col. 10 line 67.] "and (b) said tertiary coil is intended for imaging the heart of the patient from a posterior perspective." [See posterior coil 44b which images the aortic arch of the heart "from a posterior perspective" col. 6 line 49 through col. 10 line 67.] The same reasons for lack of novelty that apply to claims 53, 61 also apply to claim 63 and need not be reiterated.



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Claims 21, 29, and 30 lack novelty under PCT Article 33(2) as being anticipated by Srinivasan US patent 5,602,479 issued February 11<sup>th</sup> 1997.

With respect to volume coil Claim 21, Srinivasan '479 teaches and shows "A volume coil for use with a parallel-imaging compatible magnetic resonance (MR) system, [See figures 1-4; the abstract, col. 3 line 51 through col. 10 line 67.] Srinivasan '479 teaches and shows, "the volume coil comprising: (a) a first electrically conductive ring;" [i.e. component 80 of figure 2; component 120 of figures 6, or 7] "(b) a second electrically conductive ring; [i.e. component 84 of figure 2, or component 114 of figures 6, 7] Srinivasan '479 also shows "(c) a plurality of rods electrically interconnecting said first and said second rings to form a birdcage-like structure therewith;" [See figures 2, 6, 7, 10, and 11; In figure 2 the rods are component 82 and the birdcage structure is component 40; In figure 6 the rods are component 122 and the birdcage structure is component 112] "wherein said rods and said first and said second rings are configured to produce a plurality of electrically-adjacent primary resonant substructures about the birdcage-like structure, with each of said primary resonant substructures including two of said rods neighboring each other and a corresponding short segment of each of said first and said second rings interconnecting them, [See Srinivasan '479 figures 2, 6, 7, 10, and 11.] "so that each of said primary resonant substructures is enabled to receive a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '479 abstract, col. 5 line 64 through col. 8 line 35.] "and (d) each of said primary resonant substructures having a source impedance considerably higher than, and for creating a resonant circuit with, a load impedance to which said primary resonant substructure connects so as to enable said primary resonant substructure (i) to be operatively couplable to one processing channel of the MR system for conveyance of the magnetic resonance signal received thereby (ii) while simultaneously being at least partially decoupled from the other of said primary resonant substructures of the volume coil. [See Srinivasan '479 abstract, figures 1 through 11; table 1; col. 2 line 26 through col. 8 line 35].

With respect to volume coil claim 29, Srinivasan '479 teaches and shows that in the alternative examples birdcage coil "said second ring of said head coil" (i.e. comparing components 114, and 120) "has a diameter that is smaller than that of said first ring" [See Srinivasan '479 col. 7 lines 57-60; figures 7, 10] The same reasons for lack of novelty, that apply to claim 21 also apply to claim 29 and need not be reiterated.

With respect to volume coil claim 30, Srinivasan '479 teaches and shows from figure 2 or from figures 2, 6, 7, 10 and 11 in combination that "each of said rods has a linear portion and a tapered portion with said linear portion being connected to said first ring and said tapered portion being connected to said second ring." [See figures 2, 6, 7, 10, and 11; col. 4 line 13 through col. 8 line 35.] The same reasons for lack of novelty, that apply to claims 21, 29 also apply to claim 30 and need not be reiterated.

Claims 16, 34, 51, and 59 lack inventive step under PCT Article 33(3) as being obvious over Srinivasan US patent 5,664,568 issued September 9<sup>th</sup> 1997.

With respect to corresponding neurovascular array Claims 16, 50 and corresponding volume coil claims 33, 59; Srinivasan '568 lacks directly teaching or showing that "(a) a first group of four of said primary resonant substructures have said rods thereof spaced approximately 60 degrees apart in each of said primary resonant substructures; and (b) a second group of four of said primary resonant substructures have said rods thereof spaced approximately 30 degrees apart in each of said primary resonant substructures; with said primary resonant substructures of said first and said second groups being deployed in alternating fashion". However, Srinivasan '568 does teach that other geometries, symmetries and configurations are possible, therefore the ability to interleave a 60 degree geometric symmetry with a 30 degree geometric symmetry, is an obvious variation of "alternate embodiments" which fall within the scope of the Srinivasan '568 teachings. The same reasons for lack of novelty that apply to claims 1, 15, 21, 33, 39, 50, 53, and 58 also apply to claims 16, 34, 51, and 59 and need not be reiterated.

Claims 1-71 meet Industrial applicability under PCT Article 33(4) Therefore claims 1-71 have Industrial applicability.

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

REC'D 30 MAY 2006

PCT

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## WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:  
JAMES R. STEVENSON  
MEDRAD, INC.  
ONE MEDRAD DRIVE  
INDIANOLA, PA 15051

Date of mailing  
(day/month/year) **25 MAY 2006**

Applicant's or agent's file reference.

MR/04-001.PCT

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US05/05744

International filing date (day/month/year)

22 February 2005 (22.02.2005)

Priority date (day/month/year)

22 February 2004 (22.02.2004)

International Patent Classification (IPC) or both national classification and IPC

IPC: G01V 3/00( 2006.01)

USPC: 324/318,309

Applicant

MEDRAD, INC.

### 1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

### 2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

### 3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Date of completion of this opinion  23 April 2006 (23.04.2006)	Authorized officer <i>Lyle D. Blue Fox</i> Gutierrez Diego  Telephone No. (703)305-0956
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**Box No. I Basis of this opinion**

1. With regard to the language, this opinion has been established on the basis of:
  - ☒ the international application in the language in which it was filed
  - ☐ a translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
  - a. type of material
    - ☐ a sequence listing
    - ☐ table(s) related to the sequence listing
  - b. format of material
    - ☐ on paper
    - ☐ in electronic form
  - c. time of filing/furnishing
    - ☐ contained in the international application as filed.
    - ☐ filed together with the international application in electronic form.
    - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has, within the applicable time limit:
- ☐ paid additional fees
  - ☐ paid additional fees under protest and, where applicable, the protest fee
  - ☐ paid additional fees under protest but the applicable protest fee was not paid
  - ☒ not paid additional fees
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is
- ☐ complied with
  - ☒ not complied with for the following reasons:  
See the lack of unity section of the International Search Report (Form PCT/ISA/210)

4. Consequently, this opinion has been established in respect of the following parts of the international application:
- ☐ all parts.
  - ☒ the parts relating to claims Nos. 1-71



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Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)

Claims 16, 34, 51, 59 YES

Claims 1-15, 17-33, 35-50, 52-58, 60-71 NO

Inventive step (IS)

Claims NONE YES

Claims 1-71 NO

Industrial applicability (IA)

Claims 1-71 YES

Claims NONE NO

2. Citations and explanations:

Please See Continuation Sheet

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**Box No. VII Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

Claim 15 is objected to under PCT Rule 66.2(a)(iii) as containing the following defect(s) in the form or contents thereof: Claim 15 depends from claim C1, there is no claim C1. The examiner is treating this claim as if it depends from claim 1, a correction to the dependency is needed.

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V. 2. Citations and Explanations:

Claims 1-15, 17-29, 31-33, 35-50, 52-58, and 60-71 lack novelty under PCT Article 33(2) as being anticipated by Srinivasan US patent 5,664,568 issued September 9<sup>th</sup> 1997.

With respect to Claim 1, Srinivasan '568 teaches and shows "A neurovascular array for use with a magnetic resonance (MR) system capable of parallel-imaging via a plurality of processing channels" [See figures 1, 2, 3, 9, and 10; the abstract, col. 3 line 51 through col. 10 line 67.] Srinivasan '568 teaches and shows, "the neurovascular array comprising: (a) a head coil" (i.e. head coil birdcage assembly 42) "having: (I) a first electrically conductive ring, (II) a second electrically conductive ring, and (III) a plurality of rods electrically interconnecting said first and said second rings to form a birdcage-like structure therewith", [See figures 2 and 3, col. 6 line 49 through col. 10 line 67] "wherein said rods and said first and said second rings are configured to produce a plurality of electrically-adjacent primary resonant substructures about the birdcage-like structure, with each of said primary resonant substructures: (A) constituting a coil element including two of said rods neighboring each other and a corresponding short segment of each of said first and said second rings interconnecting them, so that each of said primary resonant substructures is enabled to receive a magnetic resonance signal from tissue within a field of view thereof, and (B) providing a source impedance considerably higher than, and for creating a resonant circuit with, a load impedance to which said primary resonant substructure connects so as to enable said primary resonant substructure (i) to be operatively couplable to one processing channel of the MR system for conveyance of the magnetic resonance signal received thereby (ii) while simultaneously being at least partially decoupled from the other of said primary resonant substructures of said head coil;" [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67]. "(b) an anterior coil having in proximity to said head coil at least one other coil element for receiving a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '568 abstract, anterior coil 44a col. 6 line 49 through col. 10 line 67] "(c) a posterior coil having in proximity to said head coil at least one other coil element for receiving a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '568 abstract, posterior coil 44b col. 6 line 49 through col. 10 line 67] "and (d) an interface for enabling said coil elements of said head coil, said anterior coil and said posterior coil to be selectively interconnected to the processing channels of the MR system so that the neurovascular array can be selectively operated in a plurality of modes." [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67].

With respect to volume coil Claim 21, and the corresponding method claim for making the volume coil Claim 71, Srinivasan '568

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teaches and shows "A volume coil for use with a parallel-imaging compatible magnetic resonance (MR) system, [See figures 1, 2, 3, 9, and 10; the abstract, col. 3 line 51 through col. 10 line 67.] Srinivasan '568 teaches and shows, "the volume coil comprising: (a) a first electrically conductive ring;" [i.e. component 88a Srinivasan '568 col. 7 lines 7-8], "(b) a second electrically conductive ring; [i.e. component 88b Srinivasan '568 col. 7 lines 7-8], "(c) a plurality of rods electrically interconnecting said first and said second rings to form a birdcage-like structure therewith;" [See the "legs of birdcage coil 42 in figures 3 and 2, col. 6 line 49 through col. 10 line 67] "wherein said rods and said first and said second rings are configured to produce a plurality of electrically-adjacent primary resonant substructures about the birdcage-like structure, with each of said primary resonant substructures including two of said rods neighboring each other and a corresponding short segment of each of said first and said second rings interconnecting them, [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67]. "so that each of said primary resonant substructures is enabled to receive a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '568 abstract, col. 4 lines 35-57; col. 6 line 32 through col. 10 line 67] "and (d) each of said primary resonant substructures having a source impedance considerably higher than, and for creating a resonant circuit with, a load impedance to which said primary resonant substructure connects so as to enable said primary resonant substructure (i) to be operatively couplable to one processing channel of the MR system for conveyance of the magnetic resonance signal received thereby (ii) while simultaneously being at least partially decoupled from the other of said primary resonant substructures of the volume coil. [See Srinivasan '568 abstract, figures 1 through 10; table 1; col. 3 line 51 through col. 10 line 67].

With respect to **Claim 39**, Srinivasan '568 teaches and shows "A neurovascular array for use with a magnetic resonance (MR) system having a plurality of processing channels" [See figures 1, 2, 3, 9, and 10; the abstract, col. 3 line 51 through col. 10 line 67.] Srinivasan '568 teaches and shows, "the neurovascular array comprising: (a) a head coil" (i.e. head coil birdcage assembly 42) "including: (I) a first electrically conductive ring;" [i.e. component 88a Srinivasan '568 col. 7 lines 7-8], "(II) a second electrically conductive ring; [i.e. component 88b Srinivasan '568 col. 7 lines 7-8], "and (II) a plurality of rods electrically interconnecting said first and said second rings to form a birdcage-like structure therewith;" [See the "legs of birdcage coil 42 in figures 3 and 2, col. 6 line 49 through col. 10 line 67] "wherein said rods and said first and said second rings are configured to produce a plurality of electrically-adjacent primary resonant substructures about the birdcage-like structure, with each of said primary resonant substructures constituting a coil element including two of said rods neighboring each other and a corresponding short segment of each of said first and said second rings interconnecting them, so that said primary resonant substructures are isolated from each other via a preamplifier decoupling scheme and an offset tuning scheme" [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67, table 1]. "thereby enabling each of said primary resonant substructures (i) to receive a magnetic resonance signal from tissue within a field of view thereof and (ii) to be operatively couplable to one processing channel of the MR system for conveyance of the magnetic resonance signal received thereby (iii) while being simultaneously decoupled from the other of said primary resonant substructures;" [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67, table 1]. "(b) an anterior coil having in proximity to said head coil at least one other coil element for receiving a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '568 abstract, anterior coil 44a col. 6 line 49 through col. 10 line 67] "(c) a posterior coil having in proximity to said head coil at least one other coil element for receiving a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '568 abstract, posterior coil 44b col. 6 line 49 through col. 10 line 67] "and (d) an interface for enabling said coil elements of said head coil, said anterior coil and said posterior coil to be selectively interconnected to the processing channels of the MR system so that the neurovascular array can be selectively operated in a plurality of modes." [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67].

With respect to **Claim 53**, and the corresponding method claim for making the volume coil **Claim 68**, Srinivasan '568 teaches and shows "A volume coil for use with a parallel-imaging compatible magnetic resonance (MR) system" [See figures 1, 2, 3, 9, and 10; the abstract, col. 3 line 51 through col. 10 line 67.] Srinivasan '568 teaches and shows, "the volume coil comprising: (a) a first electrically conductive ring;" [i.e. component 88a Srinivasan '568 col. 7 lines 7-8], "(b) a second electrically conductive ring; [i.e. component 88b Srinivasan '568 col. 7 lines 7-8], "(c) a plurality of rods electrically interconnecting said first and said second rings to form a birdcage-like structure therewith; [See the "legs of birdcage coil 42 in figures 3 and 2, col. 6 line 49 through col. 10 line 67] "wherein said rods and said first and said second rings are configured to produce a plurality of electrically-adjacent primary resonant substructures about the birdcage-like structure, with each of said primary resonant substructures including two of said rods neighboring each other and a corresponding short segment of each of said first and said second rings interconnecting them, so that said primary resonant substructures are isolated from each other via a preamplifier decoupling scheme and an offset tuning scheme" [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67, table 1]. "thereby enabling each of said primary resonant substructures (i) to receive a magnetic resonance signal from tissue within a field of view thereof and (ii) to be operatively couplable to one processing channel of the MR system for conveyance of the magnetic resonance signal received thereby (iii) while being simultaneously decoupled from the other of said primary resonant substructures." [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67, table 1].

With respect to **Claim 61**, Srinivasan '568 teaches and shows "An array for use with a magnetic resonance (MR) system having a plurality of processing channels, the array comprising: (a) a volume coil including: (I) a first ring at one end of said volume coil, said first ring being electrically conductive; (II) a second ring at an other end of said volume coil, said second ring being electrically conductive; and (II) a plurality of rods electrically interconnecting said first and said second rings to form a birdcage-like structure

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therewith; wherein said rods and said first and said second rings are configured to produce a plurality of electrically-adjacent primary resonant substructures about the birdcage-like structure, with each of said primary resonant substructures constituting a coil element including two of said rods neighboring each other and a corresponding short segment of each of said first and said second rings interconnecting them, so that said primary resonant substructures are isolated from each other via a preamplifier decoupling scheme and an offset tuning scheme thereby enabling each of said primary resonant substructures (i) to receive a magnetic resonance signal from tissue within a field of view thereof and (ii) to be operatively couplable to one processing channel of the MR system for conveyance of the magnetic resonance signal received thereby (iii) while being simultaneously decoupled from the other of said primary resonant substructures;" [See the same rejection reasons as those provided with respect to claim 53 above.] Srinivasan '568 also teaches and shows "(b) a secondary coil" [See Srinivasan '568 abstract, anterior coil 44a col. 6 line 49 through col. 10 line 67] "having at least one other coil element for receiving a magnetic resonance signal from tissue within a field of view thereof;" [See col. 6 line 49 through col. 10 line 67] "(c) a tertiary coil having at least one other coil element for receiving a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '568 abstract, posterior coil 44b col. 6 line 49 through col. 10 line 67] "and (d) an interface for enabling said coil elements of said volume coil, said secondary coil and said tertiary coil to be selectively interconnected to the processing channels of the MR system so that the array can be selectively operated in a plurality of modes." [See Srinivasan '568 abstract, figures 1 through 10; col. 3 line 51 through col. 10 line 67].

With respect to Claim 2, corresponding claim 40, Srinivasan '568 teaches and shows that "said plurality of modes includes a neurovascular phased array mode in which said interface enables: (a) each pair of said coil elements of said head coil to be interconnected with a separate one of the processing channels of the MR system;" [See Srinivasan '568 col. 9 line 36 through col. 10 line 67; table 1; col. 6 lines 32-62; col. 3 line 52 through col. 4 line 67; in combination with figures 3, 9, and 10] "and (b) each of said other coil elements of said anterior and said posterior coils to be interconnected with a separate one of the processing channels of the MR system." [See Srinivasan '568 col. 9 line 36 through col. 10 line 67; table 1; col. 6 lines 32-62; col. 3 line 52 through col. 4 line 67; in combination with figures 3, 9, and 10] The same reasons for lack of novelty, that apply to claims 1, 39 also apply to claims 2, 40 and need not be reiterated.

With respect to Claim 3, corresponding claim 41, Srinivasan '568 teaches and shows that "said head coil has eight of said coil elements and said anterior and said posterior coils each have two of said other coil elements" [See col. 10 lines 23-67], "for use with the MR system equipped with at least eight of the processing channels" [See col. 10 lines 23-67]. The same reasons for lack of novelty, that apply to claims 1, 39 also apply to claims 3, 41 and need not be reiterated.

With respect to Claim 4, corresponding claim 42, Srinivasan '568 teaches and shows that "said plurality of modes includes a high resolution brain mode in which said interface enables each of said coil elements of said head coil to be interconnected with a separate one of the processing channels of the MR system." [See table 1, col. 9 line 36 through col. 10 line 67; col. 6 lines 38-44; figures 3, 9, and 10] The same reasons for lack of novelty, that apply to claims 1, 39 also apply to claims 4, 42 and need not be reiterated.

With respect to Claim 5, corresponding claim 43, Srinivasan '568 teaches and shows that "said plurality of modes includes a volume neck mode in which said interface enables each of said other coil elements of said anterior and said posterior coils to be interconnected with a separate one of the processing channels of the MR system." [See table 1, col. 9 line 36 through col. 10 line 67; col. 6 lines 38-44; figures 3, 9, and 10] The same reasons for lack of novelty, that apply to claims 1, 39 also apply to claims 5, 43 and need not be reiterated.

With respect to Claim 6, corresponding claim 44, Srinivasan '568 teaches and shows that "said plurality of modes includes a spectroscopy mode in which said interface enables all of said coil elements of said head coil to be interconnected with a single one of the processing channels of the MR system." [See table 1, col. 9 line 36 through col. 10 line 67; col. 6 lines 32-62; col. 4 lines 36-67 figures 3, 9, and 10] The same reasons for lack of novelty, that apply to claims 1, 39 also apply to claims 6, 44 and need not be reiterated.

With respect to Claim 7, corresponding claim 45, Srinivasan '568 teaches and shows that "said interface is capable of enabling said neurovascular array to be selectively operated in said plurality of modes when said coil elements of said head coil, said anterior coil and said posterior coil are greater in number than the processing channels of the MR system." [See table 1, col. 9 line 36 through col. 10 line 67; especially col. 10 lines 23-67; col. 6 lines 32-62; col. 4 lines 36-67 figures 3, 9, and 10] The same reasons for lack of novelty, that apply to claims 1, 39 also apply to claims 7, 45 and need not be reiterated.

With respect to neurovascular array Claim 8, and corresponding volume coil claim 22, Srinivasan '568 teaches and shows that "each of said primary resonant substructures as said source impedance includes an input resonant circuit for enabling said primary resonant substructure via a low impedance preamplifier as said load impedance to be (i) operatively couplable to one processing channel of the MR system and (ii) at least partially decoupled from the other of said primary resonant substructures." [See col. 7 line 53 col. 9 line 34; col. 4 lines 2-67; and figures 3, 9, and 10; in combination with col 9 line 35 through col. 10 line 67.] The same reasons for lack of novelty, that apply to claims 1, 21 also apply to claims 8, and 22 and need not be reiterated.



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With respect to neurovascular array **Claim 9**, and corresponding volume coil claim **23**, Srinivasan '568 teaches and shows that "said low impedance preamplifiers are provided as part of the neurovascular array" (i.e. claim 9) or "volume coil" (i.e. claim 23)." [See figures 3, 9, and 10; col. 10 lines 11-67] The same reasons for lack of novelty, that apply to claims 1, 8, 21, 22 also apply to claims 9, and 23 and need not be reiterated.

With respect to neurovascular array **Claim 10**, and corresponding volume coil claim **24**, Srinivasan '568 teaches and shows that "each of said low impedance preamplifiers is provided with one of the processing channels of the MR system." [See figures 3, 9, and 10; col. 10 lines 11-67] The same reasons for lack of novelty, that apply to claims 1, 8, 21, 22 also apply to claims 10 and 24 and need not be reiterated.

With respect to neurovascular array **Claim 11**, and corresponding volume coil claim **25**, Srinivasan '568 teaches and shows that "each of said primary resonant substructures has said input resonant circuit corresponding thereto located in one of said short segment of said second ring thereof and said short segment of said first ring thereof." [See col. 3 line 51 through col. 10 line 67 in combination with figures 3, 5, 4, 4a, 4b, 6, 6a and 8c] The same reasons for lack of novelty, that apply to claims 1, 8, 21, 22 also apply to claims 11 and 25 and need not be reiterated.

With respect to neurovascular array corresponding **Claims 12**, and **13** which respectively depend from claims 1 and 8, and corresponding volume coil **Claims 26**, and **27** which respectively depend from claims 21 and 22, Srinivasan '568 teaches and shows that "each of said primary resonant substructures further includes at least one of: (a) a tuning circuit in at least one of said rods thereof; (b) a tuning circuit in said short segment thereof of said first ring; and (c) a tuning circuit in said short segment thereof of said second ring; for enabling said head coil to be tuned according to an offset tuning scheme through which each of said primary resonant substructures is (i) further decoupled from the other of said primary resonant substructures and (ii) still enabled to resonate at an operating frequency of said head coil and thus to receive the magnetic resonance signal." [See col. 3 line 51 through col. 10 line 67; figures 1 through 8c] The same reasons for lack of novelty, that apply to claims 1, 8, 21, and 22, also apply to corresponding claims 12, 13; 26, and 27; and need not be reiterated.

With respect to neurovascular array **Claim 14**, and corresponding volume coil claim **29**, Srinivasan '568 teaches and shows that in the alternative examples birdcage coil 140, or 150 of respectively figures 9 and 10 is used to uniform head/brain coverage in which "said second ring of said head coil" (i.e. either 142a, 142b, or 144 in figure 9; or 152a, 152b, 154a, or 154b of figure 10) "has a diameter that is smaller than that of said first ring" (i.e. claim 29) or "of said first ring of said head coil" (i.e. claim 14) [See components 140 or 150 of figures 9 and 10 respectively, See also col. 10 lines 23-67 where alternate embodiments and other geometries for the birdcage coil are disclosed; Additionally figure 2 also suggests this limitation the initial entry opening of figure 2 has different size diameter than the remainder of the coils structure]. The same reasons for lack of novelty, that apply to claims 1, 21 also apply to claims 14, 29 and need not be reiterated.

With respect to corresponding neurovascular array **Claims 15**, 50 which depend from claims 1 and 39 respectively, and corresponding volume coil claims **33**, 58 which depend from claims 21 and 53 respectively, Srinivasan '568 shows from figure 3 that "said plurality of electrically-adjacent primary resonant substructures of said head coil is eight in number, with each being generally deployed 45 degrees apart from its neighbor". [See figure 3, col. 10 lines 23-67.] The same reasons for lack of novelty, that apply to claims 1, 21, 39, 53 also apply to claims 15, 33, 50, 58 and need not be reiterated.

With respect to neurovascular array **Claim 17**, and corresponding volume coil claim **35**, Srinivasan '568 shows from figure 3 that "said primary resonant substructures of said head coil (i.e. claim 17) or volume coil, (i.e. claim 35) are deployed generally symmetrically about the birdcage-like structure." [See figures 3, 5; col. 10 lines 23-67.] The same reasons for lack of novelty, that apply to claims 1, 21 also apply to claims 15, 35 and need not be reiterated.

With respect to neurovascular array **Claim 18**, and corresponding volume coil claim **36**, Srinivasan '568 shows from figure 3 that "selected ones of said rods of said head coil are spaced at irregular distances from adjacent ones of said rods." [See figure 3 and the unevenly distributed rods connecting to the upper and lower connection nodes that start and then vanish.] The same reasons for lack of novelty, that apply to claims 1, 21 also apply to claims 18, 36 and need not be reiterated.

With respect to corresponding neurovascular array **Claim 19**, 52 which depend from claims 1 and 39 respectively; corresponding volume coil claims **37**, 60 which depend from claims 21 and 53 respectively, and corresponding array coil claim **67**, Srinivasan '568 teaches and shows from figure 3 that "each of said rods includes a decoupling network therein for decoupling said head coil from a radio frequency transmit field of the MR system during a transmit cycle thereof. [See col. 7 line 53 through col. 10 line 67; the abstract, col. 4 lines 2-67; and col. 6 lines 32-62] The same reasons for lack of novelty, that apply to claims 1, 21, 39, 53, and 61 also apply to claims 19, 37, 52, 60, and 67 and need not be reiterated.

With respect to neurovascular array **Claim 20**, and corresponding volume coil claim **38**, Srinivasan '568 teaches from the two different functions of the decoupling circuits that "each of said decoupling networks includes an active decoupling circuit and a

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passive decoupling circuit" because high impedance shielding during transmission is an active decoupling and isolating flowing currents within the coil assembly generally is effectively passive decoupling. [See col. 7 line 53 through col. 10 line 67; especially col. 8 line 54 through col. 9 line 34.] The same reasons for lack of novelty, that apply to claims 1, 19, 21, 37 also apply to claims 20, 38 and need not be reiterated.

With respect to volume coil claim 28, Srinivasan '568 shows from figure 3 that of claim 21 further including a combiner circuit for combining the magnetic resonance signal received by one of said primary resonant substructures with that received by at least one other of said primary resonant substructures and operatively coupling the magnetic resonance signals to one processing channel of the MR system." [See figures 1, 3, 9, 10, col. 6 line 32 through col. 10 line 67] The same reasons for lack of novelty, that apply to claims 21 also apply to claim 28 and need not be reiterated.

With respect to volume coil claim 31, Srinivasan '568 shows from figure 3 that "said second ring" (i.e. component 88b of Srinivasan '568 col. 7 lines 7-8) "has a diameter that is equal to that of said first ring" (i.e. component 88a of Srinivasan '568 col. 7 lines 7-8). The same reasons for lack of novelty, that apply to claims 21 also apply to claim 31 and need not be reiterated.

With respect to volume coil claim 32, Srinivasan '568 teaches that "said first and said second rings are one of circular and elliptical." [See Srinivasan '568 col. 10 lines 46-47] The same reasons for lack of novelty, that apply to claims 21 also apply to claim 33 and need not be reiterated.

With respect to neurovascular array Claim 46, corresponding volume coil claim 54, corresponding array claim 64, and the corresponding method claim 69, Srinivasan '568 teaches and shows that "said preamplifier decoupling scheme involves each of said primary resonant substructures having an input resonant circuit in said short segment of second ring thereof for enabling said primary resonant substructure via a low impedance preamplifier to be (i) operatively couplable to one processing channel of the MR system and (ii) decoupled thereat from the other of said primary resonant substructures. [See col. 7 line 53 col. 9 line 34; col. 4 lines 2-67; and figures 3, 9, and 10; in combination with col 9 line 35 through col. 10 line 67.] The same reasons for lack of novelty, that apply to claims 39, 53, 61 and 68 also apply to claims 46, 54, 64 and 69 and need not be reiterated.

With respect to neurovascular array Claim 47, corresponding volume coil claim 55, and corresponding array claim 65, Srinivasan '568 teaches and shows that "said low impedance preamplifiers are provided as part of the neurovascular array" (i.e. claim 47) or the "volume coil" (i.e. claim 55), or the "array" (i.e. claim 65)." [See figures 3, 9, and 10; col. 10 lines 11-67] The same reasons for lack of novelty, that apply to claims 39, 46, 53, 54, 61, and 64 also apply to claims 47, 55, and 65 and need not be reiterated.

With respect to neurovascular array Claim 48, and corresponding volume coil claim 56, Srinivasan '568 teaches and shows that "each of said low impedance preamplifiers is provided with one of the processing channels of the MR system." [See figures 3, 9, and 10; col. 10 lines 11-67] The same reasons for lack of novelty, that apply to claims 39, 46; 53, 54 also apply to claims 48 and 56 and need not be reiterated.

With respect to neurovascular array Claim 49, corresponding volume coil claim 57, corresponding array claim 66, and the corresponding method claim 70, Srinivasan '568 teaches and shows that "said offset tuning scheme involves in each of said primary resonant substructures at least one of: (a) a tuning circuit in at least one of said rods thereof; (b) a tuning circuit in said short segment thereof of said first ring; and (c) a tuning circuit in said short segment thereof of said second ring; for enabling each of said primary resonant substructures to be tuned so that signal current induced therein is effectively precluded from interfering with neighboring ones of said primary resonant substructures primarily via said first ring and said rods thereby enabling each of said primary resonant substructures (i) to be decoupled thereat from the other of said primary resonant substructures (ii) while maintaining the ability to resonate at an operating frequency of said head coil and thus to receive the magnetic resonance signal. ." [See col. 3 line 51 through col. 10 line 67; figures 1 through 8c] The same reasons for lack of novelty, that apply to claims 39, 46; 53, 54; 61, 64; and 68, 69 also apply to corresponding claims 49, 57, 66 and 70 and need not be reiterated.

With respect to array Claim 62, Srinivasan '568 teaches and shows that "(a) said volume coil is intended for imaging of a head of a patient;" [See volume coil 42] "(b) said secondary coil is intended for imaging carotid structures on one side of a neck of the patient;" [See the aortic arch on a side of the neck col. 9 line 35 through col. 10 line 67] "and (c) said tertiary coil is intended for imaging carotid structures on an other side of the neck of the patient" [See the aortic arch on an other side of the neck, along with figures 1, 2, 3, 9, and 10] and col. 9 line 35 through col. 10 line 67]. The same reasons for lack of novelty that apply to claims 53, 61 also apply to claim 62 and need not be reiterated.

With respect to array Claim 63, Srinivasan '568 teaches and shows that "(a) said secondary coil is intended for imaging a heart of a patient from an anterior perspective;" [See anterior coil 44a which images the aortic arch of the heart "from an anterior perspective" col. 6 line 49 through col. 10 line 67.] "and (b) said tertiary coil is intended for imaging the heart of the patient from a posterior perspective." [See posterior coil 44b which images the aortic arch of the heart "from a posterior perspective" col. 6 line 49 through col. 10 line 67.] The same reasons for lack of novelty that apply to claims 53, 61 also apply to claim 63 and need not be reiterated.



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Claims 21, 29, and 30 lack novelty under PCT Article 33(2) as being anticipated by Srinivasan US patent 5,602,479 issued February 11<sup>th</sup> 1997.

With respect to volume coil Claim 21, Srinivasan '479 teaches and shows "A volume coil for use with a parallel-imaging compatible magnetic resonance (MR) system, [See figures 1-4; the abstract, col. 3 line 51 through col. 10 line 67.] Srinivasan '479 teaches and shows, "the volume coil comprising: (a) a first electrically conductive ring;" [i.e. component 80 of figure 2; component 120 of figures 6, or 7] "(b) a second electrically conductive ring; [i.e. component 84 of figure 2, or component 114 of figures 6, 7] Srinivasan '479 also shows "(c) a plurality of rods electrically interconnecting said first and said second rings to form a birdcage-like structure with each of said primary resonant substructures including two of said rods neighboring each other and a corresponding short segment of each of said first and said second rings interconnecting them, [See Srinivasan '479 figures 2, 6, 7, 10, and 11.] "so that each of said primary resonant substructures is enabled to receive a magnetic resonance signal from tissue within a field of view thereof;" [See Srinivasan '479 abstract, col. 5 line 64 through col. 8 line 35.] "and (d) each of said primary resonant substructures having a source impedance considerably higher than, and for creating a resonant circuit with, a load impedance to which said primary resonant substructure connects so as to enable said primary resonant substructure (i) to be operatively couplable to one processing channel of the MR system for conveyance of the magnetic resonance signal received thereby (ii) while simultaneously being at least partially decoupled from the other of said primary resonant substructures of the volume coil. [See Srinivasan '479 abstract, figures 1 through 11; table 1; col. 2 line 26 through col. 8 line 35].

With respect to volume coil claim 29, Srinivasan '479 teaches and shows that in the alternative examples birdcage coil "said second ring of said head coil" (i.e. comparing components 114, and 120) "has a diameter that is smaller than that of said first ring" [See Srinivasan '479 col. 7 lines 57-60; figures 7, 10] The same reasons for lack of novelty, that apply to claim 21 also apply to claim 29 and need not be reiterated.

With respect to volume coil claim 30, Srinivasan '479 teaches and shows from figure 2 or from figures 2, 6, 7, 10 and 11 in combination that "each of said rods has a linear portion and a tapered portion with said linear portion being connected to said first ring and said tapered portion being connected to said second ring." [See figures 2, 6, 7, 10, and 11; col. 4 line 13 through col. 8 line 35.] The same reasons for lack of novelty, that apply to claims 21, 29 also apply to claim 30 and need not be reiterated.

Claims 16, 34, 51, and 59 lack inventive step under PCT Article 33(3) as being obvious over Srinivasan US patent 5,664,568 issued September 9<sup>th</sup> 1997.

With respect to corresponding neurovascular array Claims 16, 50 and corresponding volume coil claims 33, 59; Srinivasan '568 lacks directly teaching or showing that "(a) a first group of four of said primary resonant substructures have said rods thereof spaced approximately 60 degrees apart in each of said primary resonant substructures; and (b) a second group of four of said primary resonant substructures have said rods thereof spaced approximately 30 degrees apart in each of said primary resonant substructures; with said primary resonant substructures of said first and said second groups being deployed in alternating fashion". However, Srinivasan '568 does teach that other geometries, symmetries and configurations are possible, therefore the ability to interleave a 60 degree geometric symmetry with a 30 degree geometric symmetry, is an obvious variation of "alternate embodiments" which fall within the scope of the Srinivasan '568 teachings. The same reasons for lack of novelty that apply to claims 1, 15, 21, 33, 39, 50, 53, and 58 also apply to claims 16, 34, 51, and 59 and need not be reiterated.

Claims 1-71 meet Industrial applicability under PCT Article 33(4) Therefore claims 1-71 have Industrial applicability.